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1 460 101

PATENT SPECIFICATION

(11) 1 460 101

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(19)

(54) MOULDING OF POLYMERIC MATERIAL

(71) We, INSTITUTE po METALOZNANIE i TECHNOLOGIA na METALITE, of 53, Chapaev Str., Sofia 13, Bulgaria, a Research Institute organized under the Laws of Bulgaria, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of producing an article having a smooth non-cellular skin and a cellular core and also relates to an injection nozzle for use in carrying out the method.

According to one aspect of the present invention there is provided a method of producing an article having a smooth, non-cellular skin and a cellular core by injection moulding of a polymer material containing a blowing agent, the method comprising the steps of:

(a) injecting a first batch of the material through a nozzle into a mould at a temperature below that at which foaming takes place, and

(b) injecting a second batch of the material through the nozzle into the mould at a temperature above that at which foaming takes place,

whereby the first batch forms the skin and the second batch forms the core of the article.

According to another aspect of the present invention there is provided an injection nozzle for injecting a polymer material into a mould, the nozzle including a body having a duct for conveying the material to be injected, which duct contains an elongate electric heating element which is disposed coaxially with the duct.

The present invention also provides injection moulding apparatus including an injection nozzle in accordance with the said second aspect.

The present invention may be carried into practice in a number of ways, but one specific embodiment will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a sectional view through an injection nozzle, and

Figures 2 to 5 show sectional views through a mould at different stages during an injection moulding process.

Figure 1 shows an injection nozzle including a body consisting of two electrically conductive components 1 and 5, which are connected together by a nut 4 and are electrically insulated from each other by two insulating rings 3. The nozzle affords a through duct coaxial with which there is disposed an electric heating element 2. One end of this element 2 is welded to the component 1, while the other end is welded to the component 5. Current supply to the heating element can be switched on or off at a supply and control block 7 which is connected to a current source. The nozzle can be attached to the end of a plasticating and injection unit 6 of an injection moulding machine.

The moulding of an article, using the nozzle shown in Figure 1, will now be described with reference to Figures 2 to 5.

A polymer melt, containing a blowing agent, is heated to a temperature lower than that at which foaming takes place, i.e. lower than the decomposition temperature of the blowing agent, and a first batch 9, of unfoamed material, is injected into the mould cavity of a mould 8 (Figure 2). After the required quantity of material necessary for the formation of a smooth non-cellular skin has been introduced into the mould, the electric heating element 2 in the nozzle is switched on, thus abruptly increasing the temperature of the polymer melt which is flowing through the nozzle to a temperature above that at which foaming occurs, i.e. above the decomposition temperature of the blowing agent, and a second batch 10, this time of foamed material, is injected into the mould (Figures 3 and 4). Heating continues until enough foamed material has been introduced into the mould to form the cellular core. Towards the end of the filling process the electric heating element 2 is switched off in order to reduce the temperature of the material below the

decomposition temperature of the blowing agent, and a third batch 11, again of unfoamed material is injected into the mould, so as to obtain a non-cellular skin in the area of the sprue (Figure 5). The penetration of the material into all parts of the mould cavity takes place under the action of the pressure of the decomposition gas products, formed during the foaming of the material of the core.

WHAT WE CLAIM IS:—

1. A method of producing an article having a smooth, non-cellular skin and a cellular core by injection moulding of a polymer material containing a blowing agent, the method comprising the steps of:

(a) injecting a first batch of the material through a nozzle into a mould at a temperature below that at which foaming takes place, and

(b) injecting a second batch of the material through the nozzle into the mould at a temperature above that at which foaming takes place,

whereby the first batch forms the skin and the second batch forms the core of the article.

2. A method as claimed in claim 1, including the further step, after injecting the second batch, of injecting a third batch of the material at a temperature below that at which foaming takes place to afford a non-cellular skin portion in the region where the material is introduced into the mould.

3. An injection nozzle for injecting a polymer material into a mould, the nozzle including a body having a duct for conveying the material to be injected, which duct contains an elongate electric heating element which is disposed coaxially with the duct.

4. An injection nozzle as claimed in claim 3, in which the body comprises two electrically conductive components, each end of the heating element being connected to one respective component, the components being otherwise electrically insulated from each other, each component being provided with means for connecting it to a current source.

5. An injection nozzle substantially as specifically described herein with reference to the accompanying drawings.

6. Injection moulding apparatus including an injection nozzle as claimed in any one of claims 4 to 6.

7. A method of producing an article, the method being substantially as specifically described herein with reference to the accompanying drawings.

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1460101 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

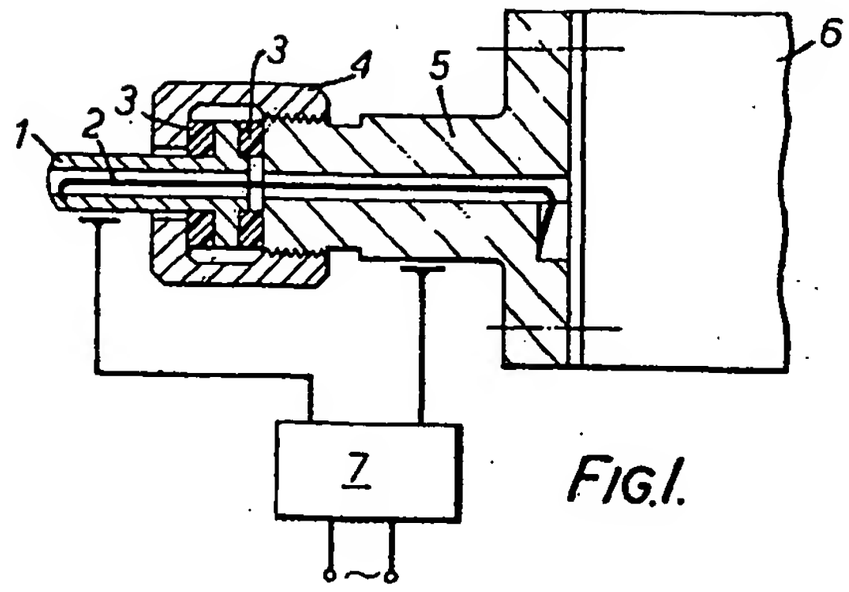

FIG.1.

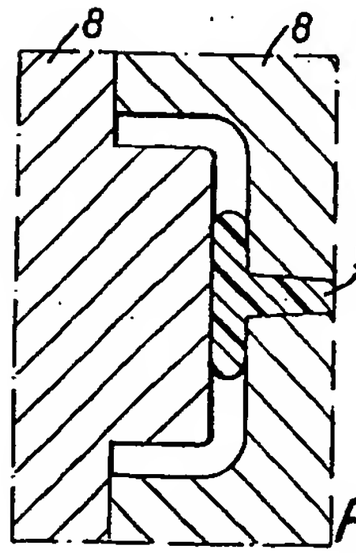

FIG.2.

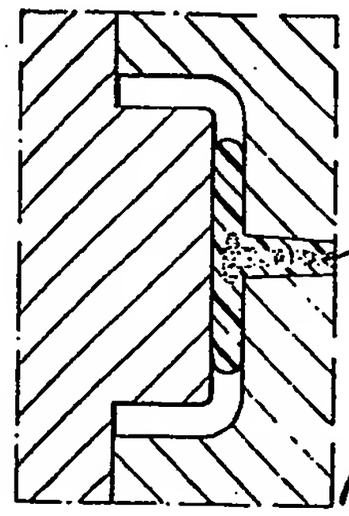

FIG.3.

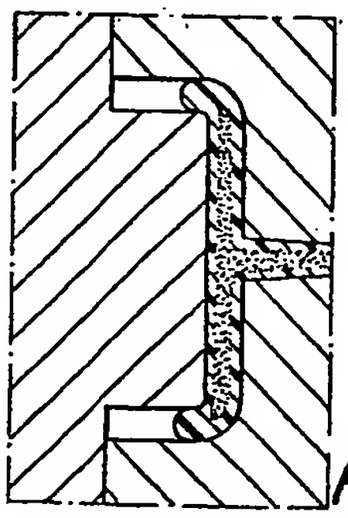

FIG.4.

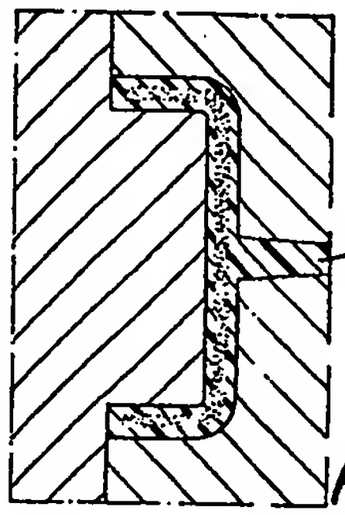

FIG.5.